(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 357 023 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.10.2003 Bulletin 2003/44

(51) Int Cl.7: B62M 9/12, B62M 25/08

(21) Application number: 02425271.0

(22) Date of filing: 26.04.2002

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(71) Applicant: CAMPAGNOLO S.R.L.
I-36100 Vicenza (IT)

(72) Inventor: Dal Pra', Giuseppe
36010 Zané VC (IT)

(74) Representative: Checcacci, Giorgio et al
Porta, Checcacci & Associati S.p.A.
Viale Sabotino 19/2
20135 Milano (IT)

(54) **Actuator for a bicycle gear-shift**

(57) The actuator device (10, 100) for a bicycle gear-shift comprises: an articulated quadrilateral mechanism (11) with four connecting rods (21, 22, 23, 24) hinged together according to four pin axes (31, 32, 33, 34) by four pin elements (41, 42, 43, 44), in which the first connecting rod (21) is intended to be integrally fixed to a bicycle frame, the second connecting rod (22) is opposite to the first connecting rod (21) in the articulated quadrilateral (11) and is intended to be fixed to a support for a gear-shift derailleur; and a motor member (12), having a variable length according to a drive axis (13) and active between two opposite pin elements (41, 42) to move them towards and away from each other deforming the articulated quadrilateral (11). According to the invention the drive axis (13) perfectly intersects the pin axis (32) of at least one (42) of the two pin elements (41, 42) between which the drive member (12) is active and intersects at least substantially the pin axis (31, 32) of both of the two pin elements (41, 42) between which the drive member (12) is active.

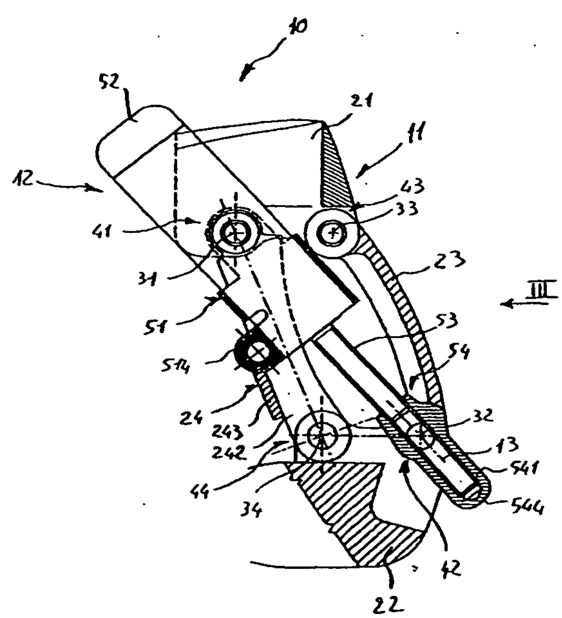

FIG. 1

Printed by Jouve, 75001 PARIS (FR)

EP 1 357 023 A1

Description

[0001] The present invention refers to an actuator for a bicycle gear-shift, that is a mechanical device which causes the displacement of the chain between different toothed wheels, for such a purpose displacing a derailleur by which the chain itself is guided.

[0002] In the context of this patent description and of the following claims, the gear-shift to which it is referred can equally be the rear one, which displaces the chain between the different sprockets associated with the rear wheel of the bicycle, or the front one, which displaces the chain between the different gears associated with the pedal cranks.

[0003] Usually, the actuator device of the gear-shift comprises an articulated quadrilateral mechanism (typically an articulated parallelogram) with four connecting rods hinged together according to four pin axes by four pin elements, in which the first connecting rod is integrally fixed to the bicycle frame, the second connecting rod (opposite to the first connecting rod in the articulated quadrilateral) is fixed to a support for the gear-shift derailleur; the deformation of the articulated quadrilateral determines the displacement of the derailleur and therefore the gear-change.

[0004] The aforementioned deformation of the articulated quadrilateral can be obtained manually, through the movement of control levers transmitted to the actuator through a cable of the Bowden type, or with an electric motor which - following an appropriate command given by the cyclist and through an appropriate mechanism - displaces different parts of the articulated quadrilateral one another, deforming it and thus displacing the derailleur.

[0005] A constant object of manufacturers of gear-shifts is that of improving the precision of actuation, upon which depends the ease and reliability of the gear-shift. This requirement is clearly stronger the more the gear-shift is intended to be used in high-level cycling competition. The adoption of electric motor components makes such a requirement even stronger, because the deformation action in such a case is very direct, without the mediation of the Bowden cable.

[0006] Therefore, the present invention regards an actuator device for a bicycle gear-shift, comprising: - an articulated quadrilateral mechanism with four connecting rods hinged together according to four pin axes by four pin elements, in which the first connecting rod is intended to be integrally fixed to a frame of the bicycle, the second connecting rod is opposite to the first connecting rod in the articulated quadrilateral and is intended to be fixed to a support for a gear-shift derailleur;

- a motor member, having a variable length according to a drive axis and active between two opposite pin elements to move them towards and away from each other deforming the articulated quadrilateral;

characterised in that

- the drive axis substantially intersects the pin axis of both the two pin elements between which the drive member is active.

[0007] With the term "substantially intersects" it is meant that the distance between the drive axis and the pin axis is less than the diameter of the pin element.

[0008] In this way, the deformation action substantially takes place along one of the diagonals of the articulated quadrilateral; this ensures the best conditions for controlling the deformation itself and thus for controlling the movement of the second connecting rod with the derailleur.

[0009] The conditions for controlling the deformation are even better in a preferred solution in which the drive axis perfectly intersects at least one of the pin axes, by this meaning that the distance between said axes becomes minimal and only comprises the typical tolerances of mechanical processings.

[0010] Even more preferably, the drive axis perfectly intersects the pin axis of both the two pin elements between which the drive member is active. In this way, indeed, the deformation action takes place exactly along one of the diagonals of the articulated quadrilateral.

[0011] Preferably, the articulated quadrilateral is an articulated parallelogram. In fact, usually it is desired that the derailleur be moved in translational motion with respect to the bicycle frame; nevertheless it is not ruled out that particular applications can suggest to also give controlled rotations to the derailleur, in such a case making suitable the use of an articulated quadrilateral other than a parallelogram.

[0012] The motor member with a variable length can be of various types; for the purposes of the invention, indeed, it is not relevant how the variation in length along the drive axis is obtained. Preferably, however, the motor member comprises an electric motor housed on a support mounted on a first of the pin elements, a screw arranged axially along the drive axis and put into rotation by the electric motor, a nut screw engaged with the screw and fixed to a second of the pin elements opposite to the first, wherein the drive axis perfectly intersects the axis of the second pin element. The rotating screw-nut screw solution is appreciated for its construction simplicity and for the ease with which it allows the length variations of the drive member to be controlled; indeed, there is direct proportionality between angles of rotation (or better number of turns) and length variation .

[0013] Usually, the connecting rods have a substantial width in the direction of the pin axes, defining with such a width an inner space of the articulated quadrilateral; with respect to such an inner space, the drive member can be placed externally (suitably extending the pin elements) or - preferably - internally. The internal positioning indeed determines a lower encumbrance of the actuator and a more balanced and therefore more pre-

cise actuation of the drive member.

[0014] To allow the aforementioned internal positioning of the drive member together with the perfect intersection of the drive axis with the axes of the pin elements, preferably the nut screw comprises an internally threaded tubular body, and two opposite pin portions perpendicular to the tubular body. In practice, therefore, the nut screw itself becomes part of the second pin element.

[0015] With such a nut screw, preferably, the second pin element moreover comprises two opposite pins, each inserted into hinging holes formed in the connecting rods converging in the second pin element and in the pin portions of the nut screw. This solution allows an easy assembling of the pin element and of the connecting rods.

[0016] Preferably, a degree of freedom is provided between the motor and the articulated quadrilateral, by this meaning that at least one relative movement - even modest - between the motor and the articulated quadrilateral is allowed. This degree of freedom ensures that the action of the motor is transferred to the quadrilateral, without anomalous stresses due to small imprecisions in shape or assembly of the parts being created.

[0017] Such a degree of freedom can be achieved in various ways. According to a preferred way, the degree of freedom is provided by a clearance which allows the nut screw to make small displacements in the direction of the axis of the second pin element. According to another preferred way, the degree of freedom is provided by a Hooke's joint between the screw and the motor. The first solution is clearly cheaper (even though sufficiently efficient); the second solution is certainly more efficient, but more expensive.

[0018] Preferably, the tubular body of the nut screw is closed at one of its ends and has a length such as to receive the screw during the maximum contraction of the drive member. The closing of the tubular body guarantees the better protection of the threaded coupling between screw and nut screw against dirt and impurities during the use of the bicycle on which the actuator is mounted.

[0019] Preferably, the device comprises a mechanical fuse in the coupling between the drive element and the articulated quadrilateral mechanism. By mechanical fuse it is meant a mechanical element in the kinematic chain interposed between the motor and the articulated quadrilateral which is provided with a limited and predetermined stress resistance, lower than the resistance of all the other elements. In such a way, in the presence of anomalous high-intensity stresses on the actuator (due for example to knocks caused by the bicycle falling down), a yielding takes place on the mechanical fuse, and not on the other elements which are thus protected.

[0020] The mechanical fuse can be realised in various ways.

[0021] According to a preferred embodiment, the mechanical fuse comprises a coupling with a calibrated interference between the electric motor and its support, such as to allow relative axial displacements only when a predetermined holding stress is exceeded. In the case of a knock, the quadrilateral shall be able to freely deform without damages because of the axial withdrawal of the motor from its support.

[0022] According to another preferred embodiment, the mechanical fuse comprises a coupling with calibrated interference between a threaded bush engaged with the screw of the motor and a receiving seat thereof in the tubular element of the nut screw, such as to allow relative axial displacements only when a predetermined holding stress is exceeded. In the case of a knock, the quadrilateral shall be able to freely deform without damages because of the axial withdrawal of the bush from the nut screw.

[0023] According to a further preferred embodiment, the mechanical fuse comprises a coupling with calibrated interference between the Hooke's joint and at least one of the motor or the threaded screw. In the case of a knock, the quadrilateral shall be able to freely deform without damages because of the axial withdrawal of the Hooke's joint.

[0024] Further characteristics and advantages of the invention shall become clearer from the following description of some preferred embodiments, given with reference to the attached drawings. In such drawings:

- figures 1 and 2 are partial section views of an actuator device according to a first embodiment of the invention, in two different operating positions;
- figure 3 is a partial section view (and with parts partially removed) of the device of figures 1 and 2 in a further operating position (intermediate between those illustrated in figures 1 and 2), taken in the direction of the arrow III;
- figure 4 is an enlarged view of a detail of figure 3;
- figure 5 is a view of the same detail of figure 4, in a different operating condition;
- figures 6 and 7 are partial section views of an actuator device according to a second embodiment of the invention, in two different operating positions;
- figure 8 is an enlarged partial section view of a detail of the device of figures 6 and 7, taken in the direction of the arrow VIII.

[0025] With reference to figures 1 to 5, with reference number 10, a bicycle gear-shift actuator device is wholly indicated; both the gear-shift and even more so the bicycle are not part of the invention and are not illustrated.

[0026] The actuator device 10 comprises an articulated quadrilateral mechanism 11 made up of four connecting rods: a first connecting rod 21 intended to be fixed integrally to the bicycle frame, a second connecting rod 22 opposite to the first connecting rod 21 in the articulated quadrilateral 11 and intended to be fixed to a support for a gear-shift derailleur, a third connecting rod 23 and a fourth connecting rod 24. The four connecting

rods 21, 22, 23 and 24 are articulated together according to four parallel pin axes 31, 32, 33 and 34 by four respective pin elements 41, 42, 43 and 44, so as to form the aforementioned articulated quadrilateral 11.

[0027] It should be noted (figure 3) that the connecting rods 21, 22, 23 and 24 have a substantial width in the direction of the pin axes 31, 32, 33 and 34; thanks to such a width, an internal space is defined in the articulated quadrilateral 11 between the connecting rods 21, 22, 23 and 24 and the pin elements 41, 42, 43 and 44.

[0028] It should also be noted that both the connecting rods 21, 22, 23 and 24 and the pin elements 41, 42, 43 and 44 can have whatever shape, more or less complex. For example, the first connecting rod 21 has a relatively massive configuration, just like the second connecting rod 22; the connecting rod 23, instead, has a substantially plate-shaped configuration, whereas the connecting rod 24 is made up of a monolithic structure with two parallel arms 241 and 242 joined by a bridge 243. Equally, the pin elements 43 and 44 are simple pins, whereas the pin elements 41 and 42 have a more complex structure, as shall be illustrated shortly.

[0029] As for the sizes, in the illustrated actuator device 10 the distances between the pin axes 31, 32, 33 and 34 are equal in pairs: the distance between the axes 31 and 33 is equal to the distance between the axes 32 and 34, just as the distance between the axes 31 and 34 is equal to the distance between the axes 32 and 33. This means that the articulated quadrilateral 11 is more precisely an articulated parallelogram, and that therefore - given the fixed condition of the connecting rod 21 fixed to the bicycle frame - a deformation of the articulated quadrilateral 11 implies that the connecting rod 22 moves with translational motion along a circular path, defined by the connecting rods 23 and 24. If the quadrilateral 11 were not a parallelogram, the motion of the connecting rod 22 would have not only a translational component, but also a rotational component; such a situation is usually not desired, but could be useful in certain conditions, to give particular movements to the gear-shift derailleur.

[0030] The actuator device 10 also comprises a drive member 12, having a variable length along a drive axis 13. The drive member 12 in turn comprises an open-cradle support 51, mounted on the first pin element 41. More precisely, the support 51 is made up of a monolithic structure with two side members 512 and 513 connected by a bridge 514; the two side members 512 and 513 are provided with respective eyelets 514 and 515, facing each other and aligned so as to be able to receive conventional locking means, such as a bolt (not shown in the figures).

[0031] The assembling of the support 51 on the pin element 41 is obtained in the following manner. The connecting rod 21 has two wings 211 and 212 which surround the arms 241 and 242 of the connecting rod 24, which in turn surround the side members 512 and 513; the pin element 41 consists of two pins 411 and 412, each inserted in holes formed along the axis 31 in the elements 211, 241 and 512 and 212, 242 and 513, respectively.

[0032] The drive member 12 moreover comprises an electric motor 52, housed and fixed in the support 51. The motor 52 is provided with an output shaft made up of a screw 53, engaged with a nut screw 54, mounted on the second pin element 42, opposite to the first pin element 41 in the articulated quadrilateral 11. The rotation of the screw 53 determines the sliding of the nut screw 54 on the screw 53 itself and consequently the variation in length of the drive member 12, a length which is considered between the motor 52 fixed to the pin element 41 and the nut screw fixed to the opposite pin element 42. This variation in length of the drive member 12 in turn determines a corresponding deformation of the articulated quadrilateral 11.

[0033] The nut screw 54 comprises a tubular body 541, threaded internally and engaged with the screw 53, and two pin portions 542 and 543, opposite each other and perpendicular to the tubular body 541. The tubular body 541 is closed at its end 544 and extends along the axes 13 such as to be able to receive the whole screw 53 when the drive member 12 is in its maximum contraction condition (figure 2).

[0034] The assembling of the nut screw 54 in the articulated quadrilateral 11 is obtained in the following manner. The connecting rod 22 has two wings 221 and 222 which surround the arms 241 and 242 of the connecting rod 24, which in turn surround the two pin portions 542 and 543 of the nut screw 54; the pin element 42 consists of two pins 421 and 422, each inserted in holes formed along the axis 32 in the elements 221, 241 and 542 and 222, 242 and 543, respectively.

[0035] In accordance with the invention, the drive axis 13 substantially intersects the pin axis 31 and the pin axis 32, by this meaning that the distance between the drive axis 13 and the pin axis 31 is less than the diameter of the pin element 42. In a preferred solution, moreover, the drive axis 13 perfectly intersects the pin axis 31 or the pin axis 32 or both, by this meaning that the distance between said axes becomes minimal and comprises just the typical tolerances of mechanical processings.

[0036] In the coupling between the motor 12 and the articulated quadrilateral 11 a degree of freedom is provided, that is at least a relative movement - even modest - is allowed between the motor 12 and the articulated quadrilateral 11. In the example of figures 1-5 such a degree of freedom is obtained by leaving a small clearance between the nut screw 54 (more precisely its two pin portions 542 and 543) and the wings 241 and 242 of the connecting rod 24, so that the nut screw 54 can move in the direction of the axis 32. This clearance can be better seen in the enlarged figures 4 and 5, which show two different positions of the nut screw 54, possible due to the aforementioned clearance. In an alternative version, not illustrated, the degree of freedom can be provided foreseeing that the screw 53 be distinct from

the drive shaft 52 and connected to it through a Hooke's joint. In any case, the aforementioned degree of freedom prevents small misalignments between the parts from causing harmful mechanical stresses, which are potential sources of malfunctions or even breakdown.

[0037] Figures 6-8 show another actuator device 100 for a bicycle gear-shift, similar to the actuator 10 of figures 1-5, but in addition provided with a mechanical fuse. For the sake of simplicity, there will be described only the parts of the actuator 100 which are different (or rather additional) with respect to the actuator 10; parts and elements of the actuator 100 that correspond to parts and elements of the actuator 10 shall be indicated with the same reference numbers used earlier.

[0038] The tubular body 541 of the nut screw 54 is not internally threaded, but rather it is provided with a tubular bush 545, which is internally threaded and is engaged with the screw 53 of the motor 52. The bush 545 is forcefully inserted into an axial receiving seat 546 formed in the tubular body 541; the outer dimension of the bush 545 and the inner dimension of the seat 546 are carefully chosen so that the force with which the bush 545 can be removed from the seat 546 has a predetermined value. In any case, to guarantee the impossibility of rotation of the bush 545 in the seat 546 it is possible to provide that at least one of the contact surfaces is axially scored (such a scoring is only shown in figure 8).

[0039] Figures 6 and 7 show how, in the case of a knock according to the arrow U (typical knock in the case of a bicycle falling, with the actuator device 100 mounted on it,), the bush 545 withdraws from the seat 546, thus absorbing the knock and in such a way protecting the motor 52 and the other elements of the actuator. The aforementioned coupling with calibrated interference between the bush 545 and the seat 546 thus constitutes the mechanical fuse. It should be noted that the correct operating condition can easily be reset by taking the bush 545 back into the seat 546.

[0040] In an alternative solution, not shown in the figures, the mechanical fuse can consist of a coupling with calibrated interference between the motor 52 and its support 51. This solution does not require an additional piece (such as the bush 545 of the solution above illustrated), but on the other hand it requires a control of the constructive tolerance for the outer size of the motor 52, which usually is not necessary.

[0041] Another alternative solution, not illustrated, in the case in which the degree of freedom is obtained through a Hooke's joint, is that of providing a coupling with calibrated interference on such a joint, on the side of the drive shaft 52 or of the screw 53.

Claims

1. Actuator device (10, 100) for a bicycle gear-shift, comprising
   - an articulated quadrilateral mechanism (11) with four connecting rods (21, 22, 23, 24) hinged together according to four pin axes (31, 32, 33, 34) by four pin elements (41, 42, 43, 44), in which the first connecting rod (21) is intended to be integrally fixed to the bicycle frame, the second connecting rod (22) is opposite to the first connecting rod (21) in the articulated quadrilateral (11) and is intended to be fixed to a support for a gear-shift derailleur;
   - a motor member (12), having a variable length according to a drive axis (13) and active between two opposite pin elements (41, 42) to move them towards and away from each other deforming the articulated quadrilateral (11);

   characterised in that

   - the drive axis (13) substantially intersects the pin axis (31, 32) of both the two pin elements (41, 42) between which the drive member (12) is active.

2. Device according to claim 1, in which the drive axis (13) perfectly intersects at least one of the pin axes (31, 32) of the two pin elements (41, 42) between which the motor member (12) is active.

3. Device according to claim 2, in which the motor member (12) comprises an electric motor (52) housed on a support (51) mounted on a first (41) of the pin elements, a screw (53) arranged axially along the drive axis (13) and put into rotation by the electric motor (52), a nut screw (54) engaged with the screw (53) and fixed to a second (42) of the pin elements opposite the first (41), wherein the drive axis (13) perfectly intersects the axis (32) of the second pin element (42).

4. Device according to claim 3, in which the connecting rods (21, 22, 23, 24) have a substantial width in the direction of the pin axes (31, 32, 33, 34), with such a width defining an internal space in the articulated quadrilateral (11), wherein the motor member (12) is arranged inside such an internal space.

5. Device according to claim 4, in which the nut screw (54) comprises a tubular body (541) threaded internally, and two pin portions (542, 543) opposite each other and perpendicular to the tubular body (541).

6. Device according to claim 5, in which the second pin element (42) also comprises two opposite pins (421, 422), each inserted in hinging holes formed in the connecting rods (22, 23) converging in the second pin element (42) and in the pin portions (542, 543) of the nut screw (54).

7. Device according to claim 3, in which the connecting rods (21, 22, 23, 24) have a substantial extension in the direction of the pin axes (31, 32, 33, 34), with such an extension defining an internal space of the articulated quadrilateral (11), wherein the motor member (12) is arranged outside of such an internal space.

8. Device according to claim 3, in which a degree of freedom is provided between the motor (52) and the articulated quadrilateral (11).

9. Device according to claim 8, in which the degree of freedom is provided by a clearance which allows the nut screw (54) small movements in the direction of the axis (32) of the second pin element (42).

10. Device according to claim 8, in which the degree of freedom is provided by a Hooke's joint between the screw (53) and the motor (52).

11. Device according to claim 5, in which the tubular body (541) of the nut screw (54) is closed at one of its ends (544) and has a length such as to receive the screw (53) during the maximum contraction of the motor member (12).

12. Device according to any one of the previous claims, comprising a mechanical fuse in the coupling between the motor element (12) and the articulated quadrilateral mechanism (11).

13. Device according to claims 3 and 12, in which the mechanical fuse comprises a coupling with calibrated interference between the electric motor (52) and its support (51), such as to allow relative axial movements only when a predetermined retaining stress is exceeded.

14. Device according to claims 3 and 12, in which the mechanical fuse comprises a coupling with calibrated interference between a threaded bush (545) engaged with the screw (53) of the motor (52) and a receiving seat thereof (546) in the tubular element (541) of the nut screw (54), such as to allow relative axial movements only when a predetermined holding stress is exceeded.

15. Device according to claims 10 and 12, in which the mechanical fuse comprises a coupling with calibrated interference between the Hooke's joint and at least one among the motor (52) and the threaded screw (53).

16. Device according to any one of the previous claims, in which the drive axis (13) perfectly intersects the pin axis (31, 32) of both of the two pin elements (41, 42) between which the motor member (12) is active.

17. Device according to any one of the previous claims, in which the articulated quadrilateral (11) is an articulated parallelogram.

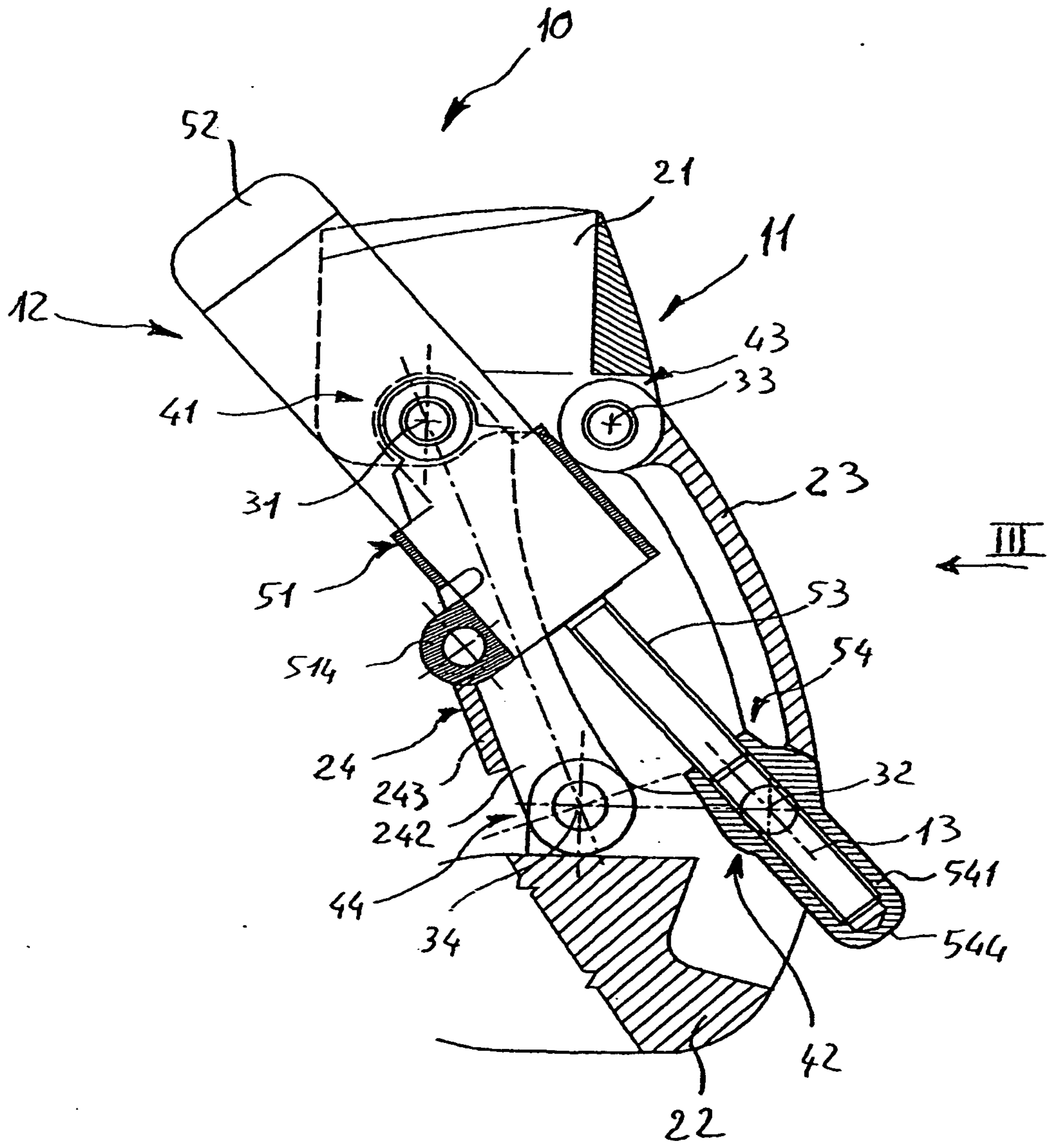
10
52
21
11
12
43
33
41
31
23
III
51
53
514
54
24
32
243
242
13
541
44
34
544
42
22

FIG. 1

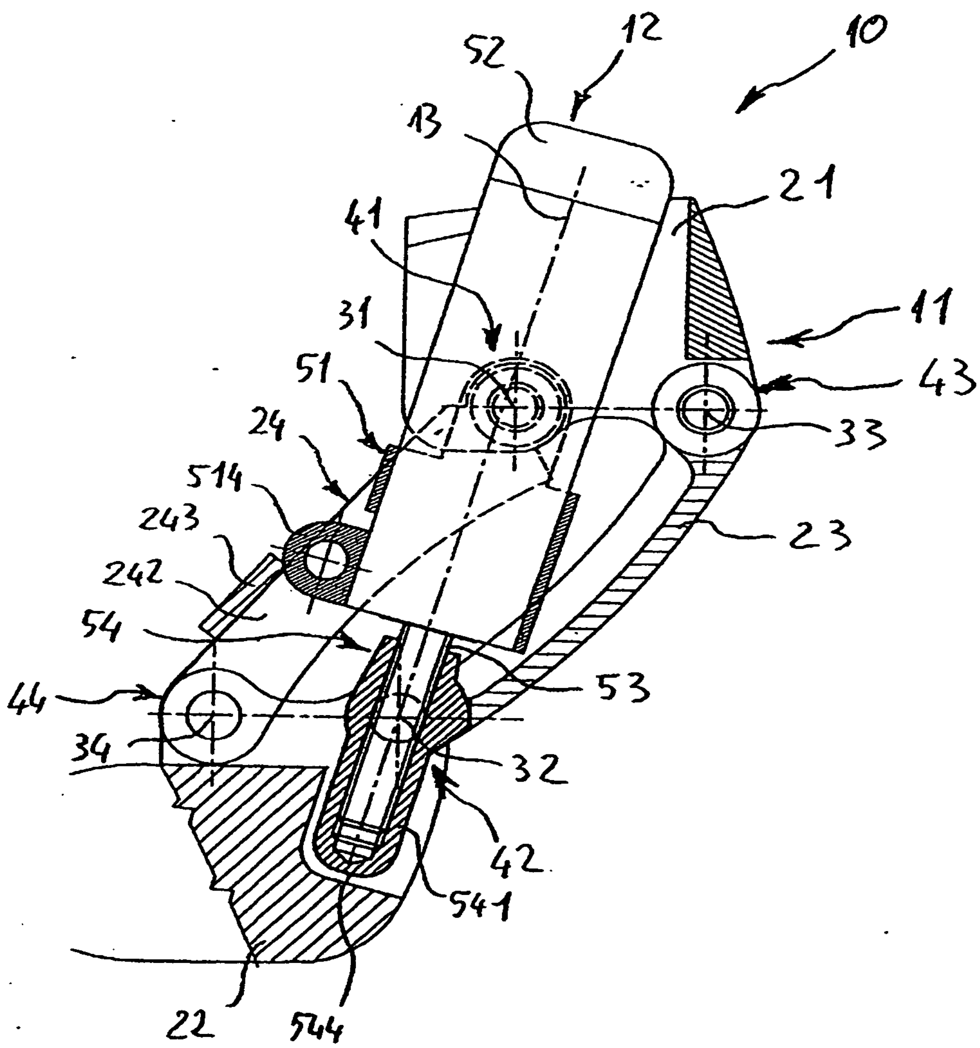
10
12
52
13
21
41
11
31
43
51
33
24
514
23
243
242
54
53
44
34
32
42
541
22
544

FIG. 2

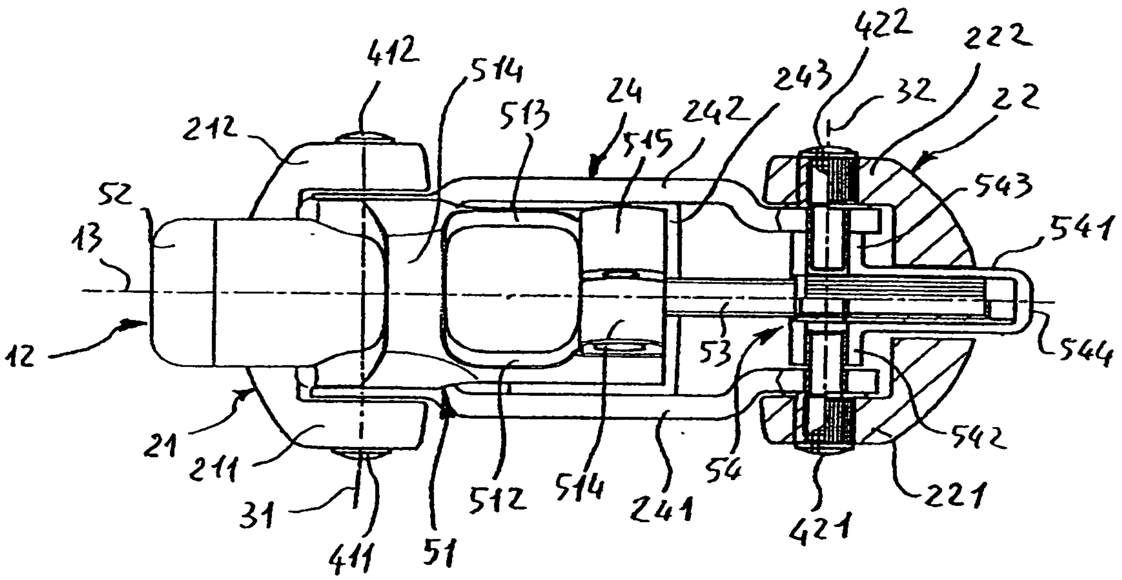
412
514
24
513
515
242
243
422
32
222
22
212
52
13
543
541
12
53
544
21
211
31
411
51
512
514
241
54
421
542
221

FIG. 3

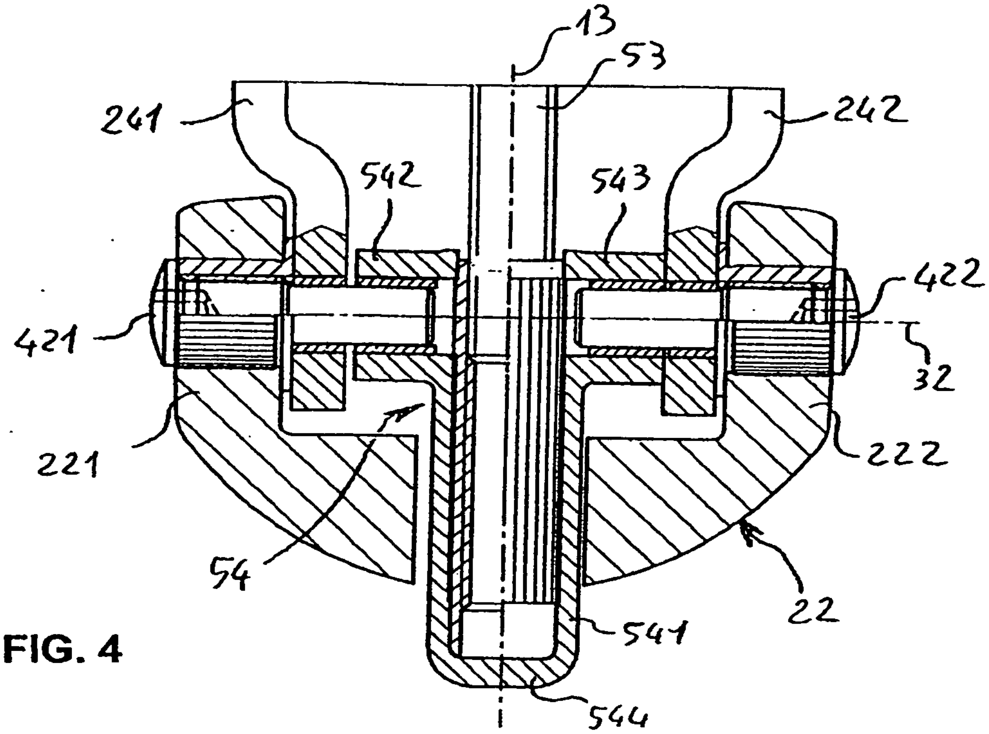
13
53
241
242
542
543
422
421
32
221
222
54
22
541
544

FIG. 4

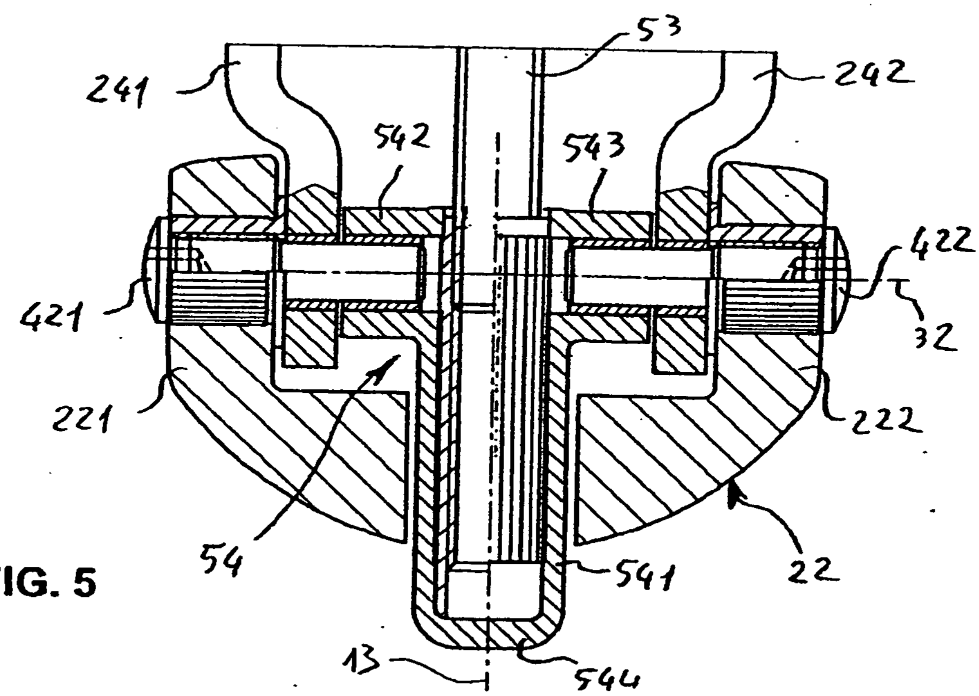
53
241
242
542
543
422
421
32
221
222
54
22
541
13
544

FIG. 5

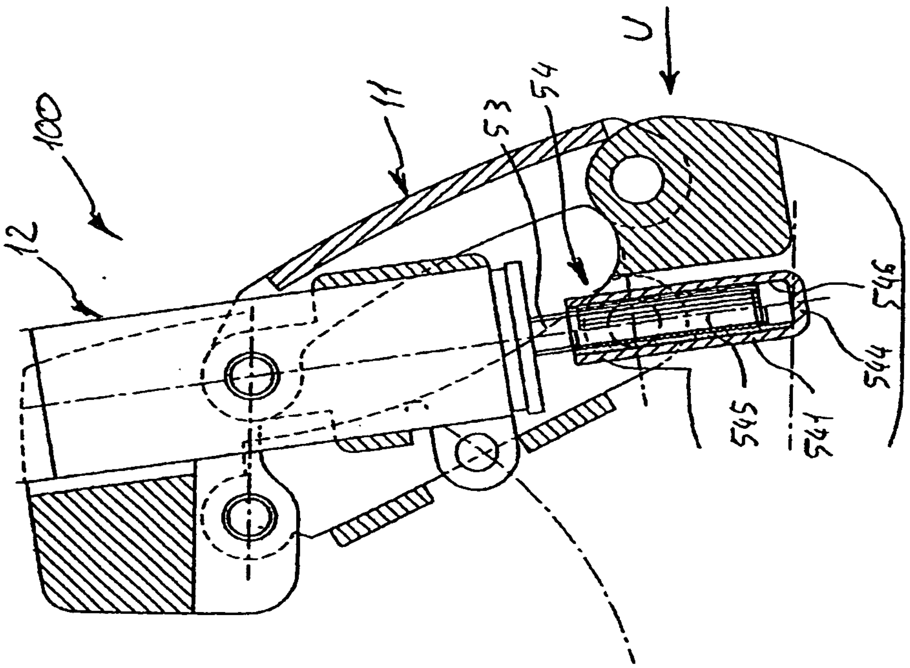

FIG. 7

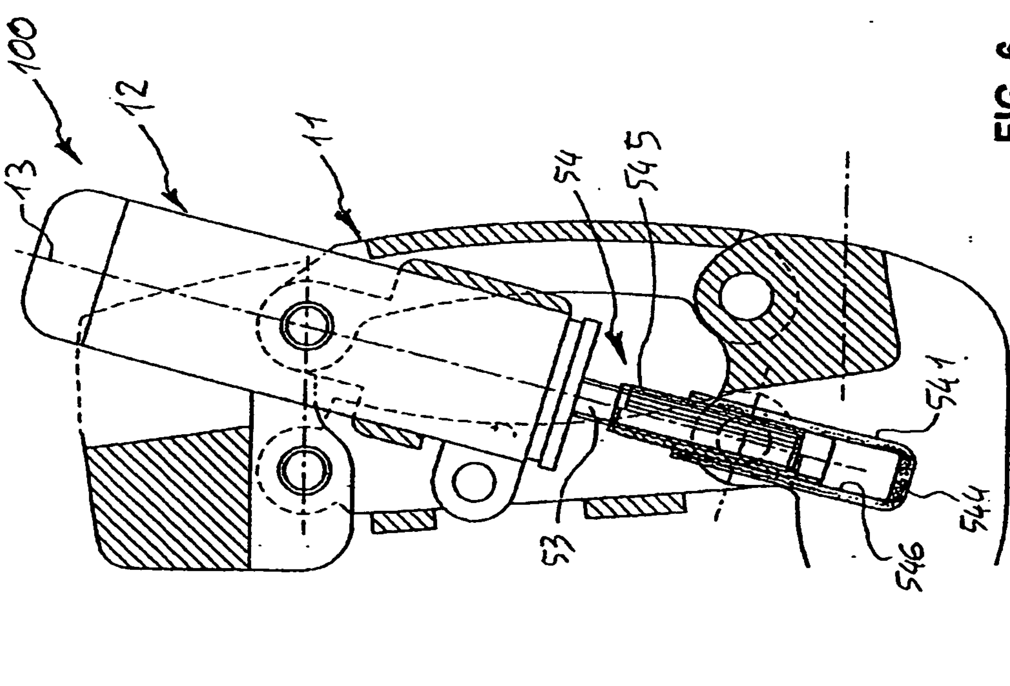

FIG. 6

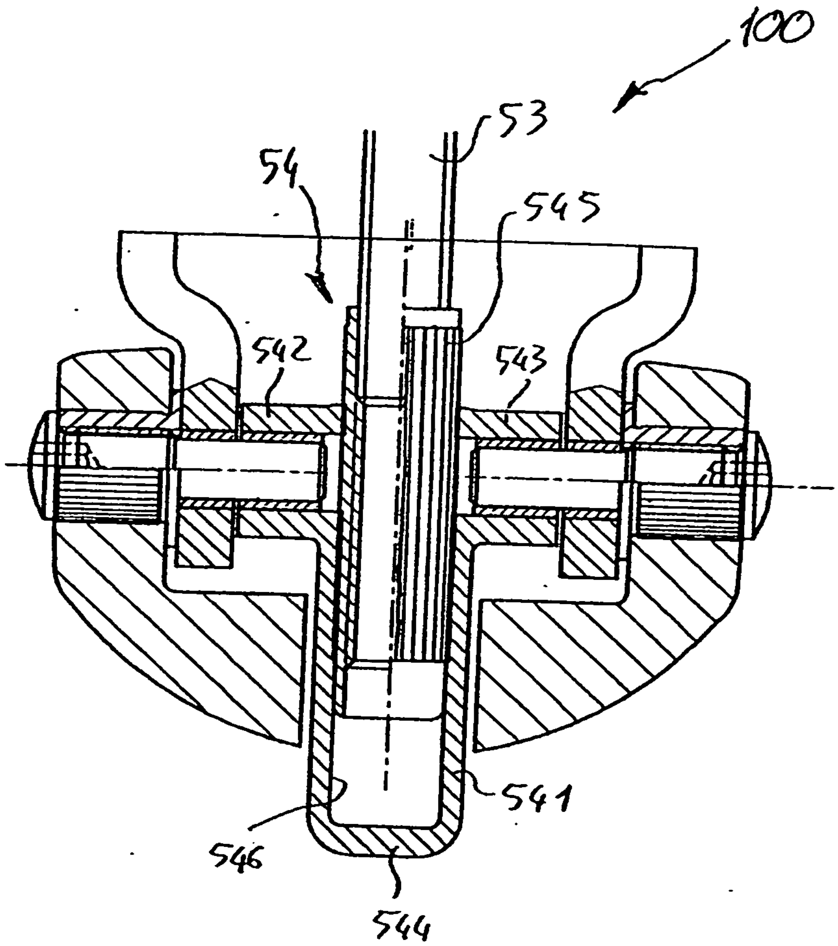

FIG. 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 42 5271

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X Y	EP 1 103 456 A (CAMPAGNOLO SRL) 30 May 2001 (2001-05-30) * abstract; figures *	1,2,17 3,4,7,8,16	B62M9/12 B62M25/08
Y	DE 39 38 454 A (ELLSAESSER DIETRICH GERHARD) 23 May 1991 (1991-05-23) * abstract; figures *	3,4,7,8,16	
X	US 6 047 230 A (ARDEN BRUCE ET AL) 4 April 2000 (2000-04-04) * abstract; figure 4 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B62M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 September 2002	Wagner, H

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 42 5271

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-09-2002

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 1103456	A	30-05-2001	IT	TO991023 A1	23-05-2001
			CN	1296896 A	30-05-2001
			EP	1103456 A2	30-05-2001
			JP	2001200930 A	27-07-2001
DE 3938454	A	23-05-1991	DE	3938454 A1	23-05-1991
US 6047230	A	04-04-2000	NONE		

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82